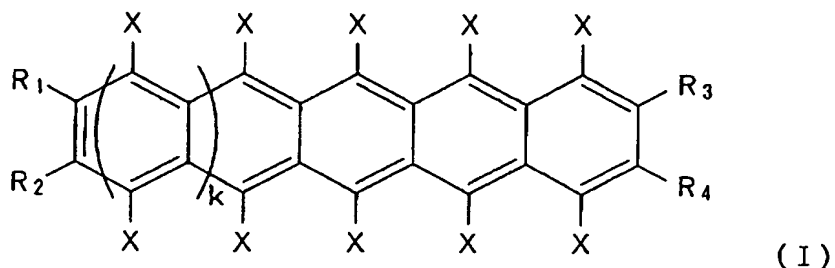


CLAIMS

1. A polyacene compound having a structure represented by the chemical formula (I):

5



wherein at least one of R_1 , R_2 , R_3 and R_4 in the chemical formula (I) is/are an aliphatic hydrocarbon group (such as an alkyl group, alkenyl group or alkynyl group), aryl group, alkoxy group, aryloxy group, acyl group, ester group, alkyloxycarbonyl group, aryloxycarbonyl group, carboxyl group, formyl group, hydroxyl group, halogen group, amino group, imino group, amide group, cyano group, silyl group, mercapto group, sulfide group, disulfide group or sulfonyl group, or a functional group containing 2 or more groups thereof, and the other(s) is/are a hydrogen atom, some of Xs is/are a halogen group and the other(s) is/are a hydrogen atom, and k is an integer of 1 to 5.

2. The polyacene compound according to claim 1, wherein R_3 and R_4 are each a hydrogen atom.

3. The polyacene compound according to claim 1, wherein at least one of the combinations (R_1 and R_2) and (R_3 and R_4) forms

a cyclic structure, after R_1 and R_2 or R_3 and R_4 are bound to each other.

4. The polyacene compound according to any one of claims 1 to 3, wherein R_1 , R_2 , R_3 and R_4 have 1 to 15 carbon atoms, when they are functional groups.

5. The polyacene compound according to any one of claims 1 to 3, wherein R_1 , R_2 , R_3 and R_4 have 2 to 15 carbon atoms, when they are functional groups.

6. The polyacene compound according to any one of claims 1 to 3, wherein R_1 , R_2 , R_3 and R_4 have 2 to 6 carbon atoms, when they are functional groups.

7. The polyacene compound according to any one of claims 1 to 3, wherein an even number of Xs are each a halogen group, at least 2 of which are bound to the same acene ring.

8. The polyacene compound according to any one of claims 1 to 3, wherein two of Xs are each a halogen group and bound to the same acene ring.

9. The polyacene compound according to any one of claims 1 to 3, wherein k is 1 or 2.

10. An inorganic semiconductor thin film made of the polyacene compound according to any one of claims 1 to 9 and having crystallinity.

11. The organic semiconductor thin film according to claim 10 formed on a substrate, wherein the major axis of the molecule of the polyacene compound is oriented at a right angle to the substrate surface.

12. An organic semiconductor device composed of the organic semiconductor thin film according to claim 10 or 11, at least partly.

13. A transistor comprising a gate electrode,
5 dielectric layer, source electrode, drain electrode and semiconductor layer, wherein the semiconductor layer is composed of the organic semiconductor thin film according to claim 10 or 11.

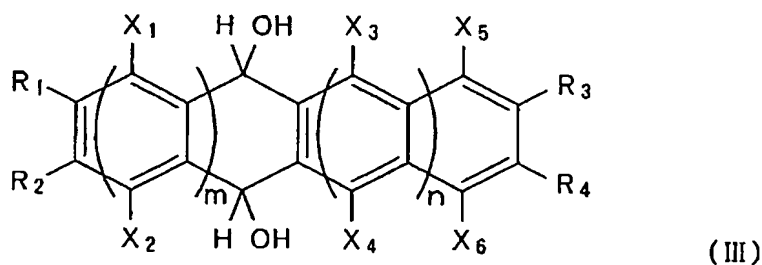
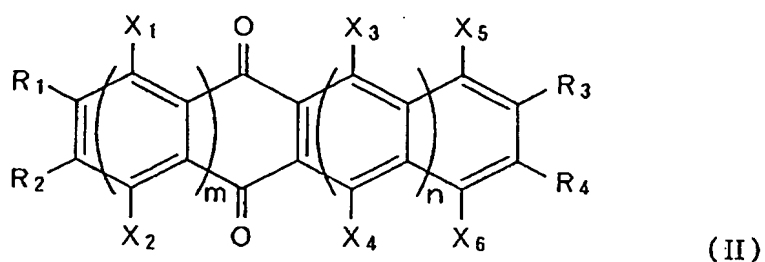
14. A method for producing the polyacene compound
10 according to any one of claims 1 to 9, comprising reducing a polyacenequinone derivative into a hydroxypolyacene derivative, and then halogenating and aromatizing the hydroxypolyacene derivative into the polyacene compound, wherein

15 the polyacenequinone derivative has a chemical structure corresponding to that of the polyacene compound according to any one of claims 1 to 9, has the same number of 6-membered rings and the same R_1 , R_2 , R_3 and R_4 , and has the carbonyl carbon of quinone, the carbon atom of which will be bound to a halogen
20 group, when it is converted into the polyacene compound, and

the hydroxypolyacene derivative has a chemical structure corresponding to that of the polyacene compound according to any one of claims 1 to 9, has the same number of 6-membered rings and the same R_1 , R_2 , R_3 and R_4 , and has a carbon atom
25 bound to a hydroxyl group and hydrogen atom, which will be bound to a halogen group, when it is converted into the polyacene compound.

15. A method for producing the polyacene compound

according to any one of claims 1 to 9, comprising reducing
a polyacenequinone derivative having a structure represented
by the chemical formula (II) into a hydroxypolyacene derivative
having a structure represented by the chemical formula (III),
5 and then halogenating and aromatizing the hydroxypolyacene
derivative,

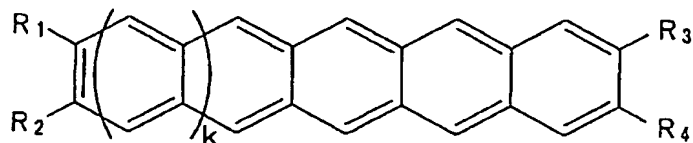


10

wherein at least one of R_1 , R_2 , R_3 and R_4 in the chemical formulas
(II) and (III) is/are an aliphatic hydrocarbon group (such
as an alkyl group, alkenyl group or alkynyl group), aryl group,
15 alkoxy group, aryloxy group, acyl group, ester group,
alkyloxycarbonyl group, aryloxycarbonyl group, carboxyl
group, formyl group, hydroxyl group, halogen group, amino group,
imino group, amide group, cyano group, silyl group, mercapto
group, sulfide group, disulfide group or sulfonyl group, or
20 a functional group containing 2 or more groups thereof, and

the other(s) is/are a hydrogen atom; X_1 , X_2 , X_3 , X_4 , X_5 and X_6 in the chemical formulas (II) and (III) are each a halogen group or hydrogen atom, unless all of X_1 , X_2 , X_3 , X_4 , X_5 and X_6 are each a halogen group; m is an integer of 2 or more, and $m+n$ is an integer of 3 to 7.

16. A hydroxypolyacene derivative having a chemical structure corresponding to that of the polyacene, represented by the chemical formula (IV), having the same number of 6-membered rings and the same R_1 , R_2 , R_3 and R_4 , and having at least one carbon atom, except for the one to which R_1 , R_2 , R_3 or R_4 will be bound when it is converted into the polyacene, bound to a hydroxyl group and hydrogen atom,



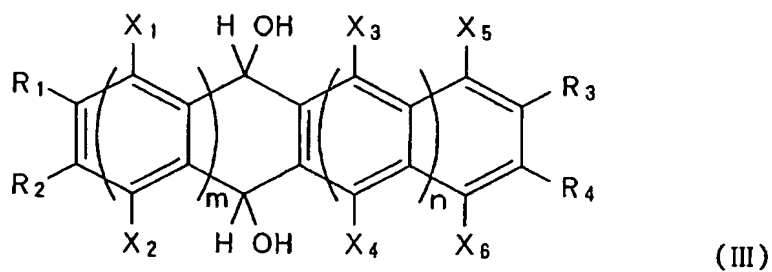
(IV)

wherein at least one of R_1 , R_2 , R_3 and R_4 in the chemical formula (IV) is/are an aliphatic hydrocarbon group (such as an alkyl group, alkenyl group or alkynyl group), aryl group, alkoxy group, aryloxy group, acyl group, ester group, alkyloxycarbonyl group, aryloxycarbonyl group, carboxyl group, formyl group, hydroxyl group, halogen group, amino group, imino group, amide group, cyano group, silyl group, mercapto group, sulfide group, disulfide group or sulfonyl group, or a functional group containing 2 or more groups thereof, and

the other(s) is/are a hydrogen atom; and k is an integer of 1 to 5.

17. A hydroxypolyacene derivative having a chemical structure represented by the chemical formula (III):

5



wherein at least one of R_1 , R_2 , R_3 and R_4 in the chemical formula (III) is/are an aliphatic hydrocarbon group (such as an alkyl group, alkenyl group or alkynyl group), aryl group, alkoxy group, aryloxy group, acyl group, ester group, alkyloxycarbonyl group, aryloxycarbonyl group, carboxyl group, formyl group, hydroxyl group, halogen group, amino group, imino group, amide group, cyano group, silyl group, mercapto group, sulfide group, disulfide group or sulfonyl group, or a functional group containing 2 or more groups thereof, and the other(s) is/are a hydrogen atom; X_1 , X_2 , X_3 , X_4 , X_5 and X_6 in the chemical formula (III) are each a halogen group or hydrogen atom, unless all of X_1 , X_2 , X_3 , X_4 , X_5 and X_6 are each a halogen group; and m is an integer of 2 or more, and $m+n$ is an integer of 3 to 7.